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Research Note

Top Senescence in *Sternbergia lutea* (L.) Ker–Gawl. ex Sprengel and *Narcissus tazetta* L. subsp. *tazetta*

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Abstract: *Sternbergia lutea* (L.) Ker–Gawl. ex Sprengel and *Narcissus tazetta* L. subsp. *tazetta* are two autumnal geophytes belonging to *Amaryllidaceae. N. tazetta* subsp. *tazetta* consist of some vomitory alkaloids. *S. lutea* has also important alkaloids too.

In this study nitrogen (N), phosphorus (P) and potassium (K) analysis were carried out in two taxa during vegetative and generative growth phases and the results belonging to vegetative and generative growth phases were compared with each other. As a result of these analysis macroelement concentrations are higher during generative growth phase in under ground parts due to "top senescence".

Key Words: *Sternbergia lutea* (L.) Ker–Gawl. ex. Sprengel. *Narcissus tazetta* L. subsp. *tazetta*, Top senescense.

Sternberga lutea (L.) Ker–Gawl. ex Sprengel ve *Narcissus tazetta L.* subsp. *tazetta*'da Top Senesens

Özet: *Strenbergia lutea* (L.) Ker–Gawl. ex Sprengel ve *Narcissus tazetta* L. subsp. *tazetta Amaryllidaceae'ye* ait iki sonbahar geofitidir. *N. tazetta* subsp. *tazetta* kusturucu etkisi olan alkaloidlere sahiptir. *S. lutea*'da da önemli alkaloidler vardır.

Bu çalışmada vejetatif ve generatif gelişme fazlarında iki taksonda azot (N), fosfor (P) ve potasyum (K) analizleri yapılmış ve vejetatif ve generatif gelişme dönemlerine ait sonuçlar birbirleriyle karşılaştırılmıştır. Sonuçta "top senesens" olayına bağlı olarak generatif gelişme döneminde toprak altı kısımlarında makroelement konsantrasyonları daha fazladır.

Anahtar Sözcükler: *Sternbergia lutea* (L.) Ker–Gawl. ex. Sprengel. *Narcissus tazetta* L. subsp. *tazetta*, Top senesens.

Introduction

Senescence in an important process in the adaptation of higher plants. This is a well controlled process and it is not a passive decay of a plant (1).

Geophytic plants have quite interesting ecophysiological properties in respect to redistribution of macroelements between above and under ground parts at the beginning and the end of their growing season. This redistribution is highly important for the economical use of nutrients. In addition to this they have also interesting phenological properties such as flowering time (spring or autumn), the presence of protantherous or hysteranthous taxa etc. (2).

Sternbergia lutea (L.) Ker–Gawl. ex Sprengel and *Narcissus tazetta* L. subsp. *tazetta* are two autumnal geophytes belonging to *Amaryllidaceae* (3). *N. tazetta* subsp. *tazetta* consists of some vomitory alkaloids. *S. lutea* has some important alkaloids which have medicinal importance (4, 5).

In this study two autumnal geophytes were examined and macroelement analysis were carried out in above and below ground parts during vegetative and generative growth phases and the causes of similarities and dissimilarities in macroelement concentrations of different plant parts were discussed.

Material and Methods

Study Area

Plant specimens were taken from the following areas. In sampling areas the plants are densely occured. At least 15 plant specimens were used for macroelement analysis. *S. lutea specimens:* A5 Samsun; Bafra, Derbent Dam environs, alluvial soils, 20 m. *N. tazetta* subsp. *tazetta* specimens: A5 Samsun; Bafra, Balık Gölleri environs, 10m.

Methods of Chemical Analysis

Plant specimens were dried at 70 °C to the constant weight and grounded in a Wiley mill and pass through a

20 mesh sieve. Nitrogen was determined by the the semimicro Kjeldahl method with a Kjeltec Auto 1030 Analyser (Tecator, Sweden) after digesting the samples in concentrated H_2SO_4 with a selenium catalyst. For P and K analysis plant specimens were wet ashed in concentrated HNO_3 and $HClO_4$ and P was determined by using Jenway spectrophotometer and K was determined by Petracourt PFP–1 flame photometer (6).

Seven soil cores were taken from each of two taxa according to fixed spatial arrangement with a soil corer to a depth of 0–30 cm. Soil samples were air–dried and sieved to pass through a 2 mm. mesh prior to analysis. Soil texture was determined by Bouyoucus hydrometer method. pH values were measured in deionized water (1:1). Total salinity (%) was determined by conductivity bridge apparatus. Soil nitrogen (%) was determined by semi micro Kjeldahl method. Available phosphorus (kg/da) was determined by spectrophotometrically following the extraction by ammonium acetate. Available potassium (kg/da) was found by using a Petracourt PFP–1 flame photometer after nitric acid wet digestion. Organic matter (%) and $CaCO_3$ concentrations were determined by Walkley–Black method and Scheibler calcimeter, respectively (7). The results of plant and soil analysis were explained according to Allen et al. (6) and Kaçar (8).

Population density was determined by using 100 m^2 quadrats.

Results

Phenological Observations

The flowering time of *S. lutea* is the second half of October. Flowering time is rather short and fruit ripening begins. In other words *S. lutea* sharphy switches from vegetative to reproductive growth. *S. lutea* is a protantherous taxa and leaves appeared before the flowers.

The flowering time of *N. tazetta* subsp. *tazetta* is the beginning of December. Flower ingtime is a bit longer than *S. lutea. N. tazetta* subsp. *tazetta* is a protantherous taxa too.

The Results of Plant and Soil Analysis

Macroelement concentrations of above and below ground parts of *S. lutea* and *N. tazetta* subsp. *tazetta* during vegatative and generative growth phase were shown in Table 1 and 2. The differences between two growth period were shown in Table 3 and 4. As shown in Table 3 and 4 there are significant differences in respect to K (%) concentrations for two growth period in two taxa. Similary N (%) concentrations are significantly

Table 1. N, P and K (%) concentrations in above and under ground parts of *S. lutea*.

Plant Part	Element (%)	Mean Values	Extreme Values
Aboveground	N	1.03*±0.61**/0.61***±0.25	0.56–1.90/0.27–0.89
Underground	N	0.50±0.28/1.06±0.58	0.22–0.89/0.61–1.90
Aboveground	P	0.28±0.08/0.21±0.17	0.19–0.36/0.0.19–0.23
Underground	P	0.18±0.05/0.028±0.06	0.12–0.23/0.22–0.36
Aboveground	K	6.80±20.85/0.35±9.31	2.16–10.16/0.16–0.81
Underground	K	0.82±14.38/5.41±10.36	0.16–1.30/2.16–10.20

* Vegetative growth phase ** Standart deviation *** Generative growth phase.

Table 2. N, P and K (%) concentrations in above and under ground parts of *N. tazetta*.

Plant Part	Element (%)	Mean Values	Extreme Values
Aboveground	N	2.47±0.16/0.90±0.33	2.24–2.63/0.67–1.40
Underground	N	1.34±0.57/2.23±0.89	0.84–1.84/1.12–3.19
Aboveground	P	0.068±0.03/0.04±0.03	0.04–0.11/0.03–0.068
Underground	P	0.05±0.02/0.08±0.03	0.04–0.07/0.04–0.11
Aboveground	K	0.28±1.10/0.21±0.57	0.23–0.31/0.20–0.23
Underground	K	0.20±0.50/0.30±0.28	0.20–0.23/0.29–0.31

* Vegetative growth phase ** Standart deviation *** Generative growth phase.

Table 3. The comparison of N, P and K (%) concentrations in above and under ground parts of two taxa during vegetative growth phase.

Plant Species	Element	F. Ratio	Probability	Significance
S. lutea	N	2.497	0.1652	NS
S. lutea	P	3.631	0.1054	NS
S. lutea	K	8.664	0.0258	*
N. tazetta subsp. *tazetta*	N	14.333	0.0091	*
N. tazetta subsp. *tazetta*	P	1.561	0.2581	NS
N. tazetta subsp. *tazetta*	K	15.254	0.0079	**

* P<.05 ** P<.01 NS: Not significant

Table 4. The comparison of N, P and K (%) concentrations in above and under ground parts of two taxa during generative growth phase.

Plant Species	Element	F. Ratio	Probability	Significance
S. lutea	N	1.988	0.2082	NS
S. lutea	P	4.262	0.0845	NS
S. lutea	K	8.890	0.0246	*
N. tazetta subsp. *tazetta*	N	7.655	0.0326	*
N. tazetta subsp. *tazetta*	P	4.257	0.0775	NS
N. tazetta subsp. *tazetta*	K	72.600	0.0001432	**

* P<.05 ** P<.01 NS: Not significant

different in *N. tazetta* subsp. *tazetta* during both growth period (Table 3 and 4). There are no significant differences between vegetative and generative growth periods in respect to P (%) concentrations for both taxa (Table 3 and 4).

In vegetative growth period above ground parts have higher nutrient concentrations as compared to below ground parts. However, under ground parts have higher nurient concentrations during generative growth period inversely (Table 1 and 2).

N. tazetta subup. *tazetta* has higher nitrogen (%) concentrations in above and underground parts as compared to *S. lutea* (Table 1 and 2).

S. lutea occur on sandy–loamy soils. Soil pH values are 7.25–7.75. This taxa usually occur on neutral and slightly basic soils. Total salinity is too low. Soil N is quite high. This taxa prefers the soils rich in phosphorus and potassium. It can be occur on the soils that rich in organic matter. However it also found on the soils that poor in organic matter. $CaCO_3$ concentrations is quite high (Table 5).

N. tazetta subsp. *tazetta* occur on clay–loamy soils. Soil pH is neutral and the ranges are 6.65–6.95. Total salinity is slightly high and sometimes total salinity values can be raised to medium level. This taxa prefers the soils that rich in nitrogen phospons and potassium as the other taxa. However $CaCO_3$ concentrations is low on the contrary the other taxa (Table 6).

Discussion

Macroelement concentrations in above ground parts of *S. lutea* and *N. tazetta* subsp. *tazetta* are higher then under ground parts during vegetative growth period (Table 1 and 2). Meristematic tissues have high macroelement concentrations. For instance, high nitrogen concentrations in meristematic tissues are originated high protein content of these tissues (9, 10).

Table 5. The results of soil analysis in *S. lutea*.

Parameter	Extreme Values
pH	7.25–7.75
Total salinity (%)	0.02–0.04
N (%)	0.22–0.56
P (kg/da)	12.641–32.060
K (kg/da)	49.920–166.566
$CaCO_3$ (%)	9.74–13.22
Organic matter (%)	0.97–4.96

In generative growth period under ground parts have higher nutrient concentrations as compared to aboveground parts. Leopold (11) is distinguished various senescence types in different plants. In geophytic plants “top senescence” is seen. In such plants the aboveground parts senesce completely and new shoots appear at the beginning of the next season. The reserves in the vegatative storage organs allow a rapid growth during the initial phase (12–14). Senescence must be considered as an important process in the adaptation of higher plants to environmental conditions and optimum usage of macroelements is an important part of the adaptation to environmental conditions (15). Above ground parts of monocotyledonous herbs develop their leaves from a basal meristem however dicotyledonous herbs grow from an apical meristem. As a result of this meristematic tissues are under ground or at ground level in monocotyledonous herbs. This means that the benefit of a basal meristem at ground level, in terms of effective using of macroelements especially nitrogen, rapid transfer of nutrients to underground parts, providing protection against damage through grazing, fire etc. (9).

N concentration in above and underground parts of *N. tazetta* subsp. *tazetta* is higher than that of *S. lutea* (Table 1 and 2). In dense stands as compared to open stands nitrogen concentrations are usually high presumably related to the increasing nitrogen availability (9). According to the results of population countings the number of *N. tazetta* subsp. *tazetta* individuals per square is considerably higher than that of *S. lutea* individuals (Table 7).

It has been found that there are statistically important differences in respect to K (%) concentrations during vegetative and generative growth periods in *S. lutea* and *N. tazetta* subsp. *tazetta*. However such differences were not seen in terms of P (%) concentrations (Table 3 and 4). Potassium is a very phloem mobile ion as compared to nitrogen and phosphorus (16). Phloem mobile nutrients can be exported from senescing plant part and translocated to storage organs within the same plant (17). Similiar results in relation to nutrient concentrations were obtained in previous studies (18, 19).

Finally “top senescence” is an important strategy to the adaptation of higher plants to environmental conditions and main aim of this strategy to increase the nutrient use efficiency. So that more research is needed on “top senescence” in geophytic plants to effective solution of that phenomenon.

Table 6. The results of soil analysis in *N. tazetta* subsp. *tazetta*.

Parameter	Extreme Values
pH	6.65–6.95
Total salinity (%)	0.13–0.18
N (%)	0.41–0.85
P (kg/da)	18.549–19.923
K (kg/da)	154.836–185.334
$CaCO_3$ (%)	0.16–0.47
Organic matter (%)	9.98–10.32

Table 7. Population density of two taxa in the study area.

Species	Number of Individuals/100 m^2
S. lutea	30
N. tazetta subsp. *tazetta*	280

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